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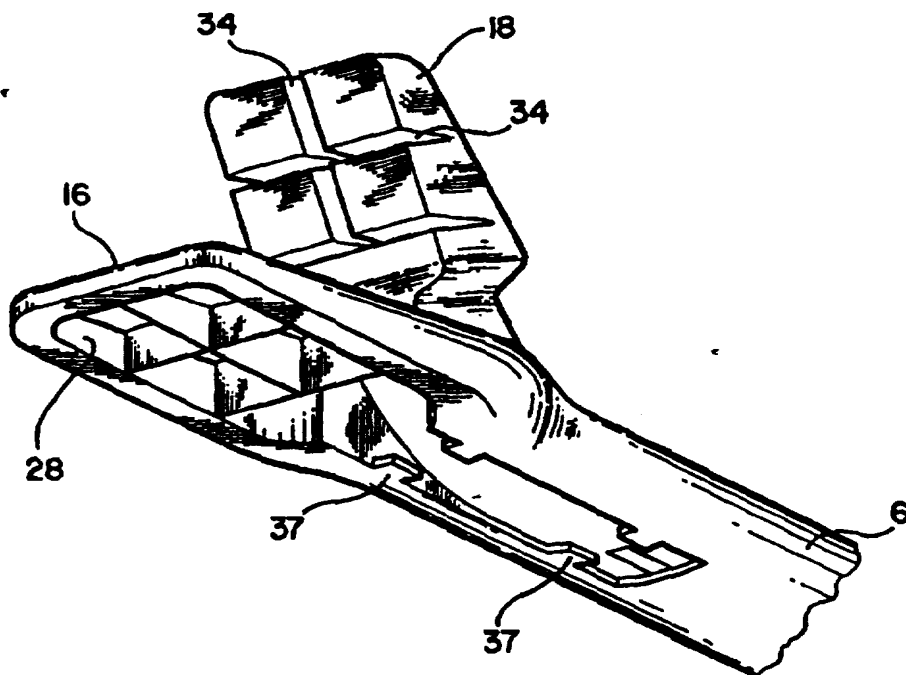
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(54) Title: ARTHROSCOPIC SURGICAL PUNCH

## (57) Abstract

A surgical punch (R) for cutting body tissue comprises an axially elongated support (6) having first and second end portions; first and second cutting jaws (16, 18) operably associated with the first end portion and movable between an open position and a closed position relatively toward and closely past each other in tissue-severing shearing action; an actuator operably associated with the second end portion for providing relative motion between the first and second jaws; and a plurality of upstanding blades (30) disposed within the opening (28) for dividing the opening into a plurality of smaller openings (36). The first jaw has the opening (28) adapted to receive the second jaw in tissue-severing action in the closed position. The second jaw cooperates with the blades when in the closed position, thereby to cut the tissue into smaller fragments substantially corresponding to the sizes of the smaller openings.



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## **ARTHROSCOPIC SURGICAL PUNCH**

### **FIELD OF THE INVENTION**

5           The present invention relates generally to a surgical punch and specifically to an arthroscopic surgical punch typically used in knee surgery.

### **BACKGROUND OF THE INVENTION**

10           Arthroscopic surgery is an orthopaedic technique consisting of introducing a fiber optic pen-like instrument into a joint, most commonly the knee, to provide a visual image of the surgery site to a video monitor which the surgeon watches to control his instruments within the knee. One of the most common procedures is a meniscectomy, 15 consisting of removing fragments of broken cartilage in the knee, using a surgical cutting instrument called a punch. Arthroscopic surgery is done under a water medium provided by cannulas to pump water into the knee and to outflow the water therefrom.

20           Punches available today are usually square-shaped and usually cut only one fragment. If the fragments are too big, sometimes the cannulas will get clogged and will need to be cleaned, which wastes valuable surgical time. Another instrument used in meniscectomy is a suction

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shaver, which is a mechanical instrument which bites and  
suctions pieces of cartilage. Fragments made from using a  
prior art punch can sometimes plug the suction shaver. An  
example of a suction shaver is disclosed in U.S. Patent No.  
5 5,217,479.

Inflow and outflow cannulas that are inserted  
above the kneecap can be made larger to accommodate larger  
fragments generated by prior art punches. However, it is  
more practical to make cannulas smaller. It is less  
10 traumatic for the knee.

Suction shaver used in meniscectomy is typically  
small in diameter because of the limited space between the  
femur and the tibia where the instrument is inserted.  
Additionally, some knees are tight and the maximum suction  
15 shaver outside diameter that can be used is about 3.5 mm.  
If a larger suction shaver is used, the articular cartilage  
could be damaged, which would be poor surgical technique.  
Thus, a prior art punch used in this area would typically  
clog the suction shaver.

20 There is therefore a need for an arthroscopic  
surgical punch that will solve the above problems.

#### OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the present invention to  
provide a surgical punch that will make smaller fragments  
25 thereby to minimize clogging of the cannulas and suction  
shavers used in the operation.

It is another object of the present invention to  
provide a surgical punch that minimizes the size of the

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cannulas and suction shavers used in the operation, thereby minimizing trauma to the knee.

It is still another object of the present invention to provide a surgical punch that will generate  
5 fragments that will minimize or eliminate clogging of the cannulas and suction shaver used in surgery to the meniscus located between the femur and tibia, especially when a bent suction shaver is used, which technically cannot be taken apart during surgery to unclog it.

10 It is yet another object of the present invention to provide a surgical punch with an arrow-triangular-shaped tip that provides easier penetration into the knee.

It is still another object of the present invention to provide a surgical punch with an arrow-  
15 triangular-shaped tip that can take round cuts on the edges of the meniscus.

In summary, the present invention provides a surgical punch that generates smaller fragments of tissue and having a tip that can relatively easily penetrate the  
20 knee and provide arcuate bites, thereby permitting a better partial meniscectomy.

These and other objects of the present invention will become apparent from the following detailed description.

25

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a side elevational view of a surgical punch made in accordance with the present invention.

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Figure 2 is an enlarged fragmentary cross-sectional view through the cutting tip of the punch of Figure 1, the phantom lines showing the movable jaw in the open position.

5                Figure 3 is a fragmentary top perspective view of one embodiment of a cutting tip made in accordance with the present invention, showing the movable jaw in the open position.

10              Figure 4 is a fragmentary bottom perspective view of the tip of Figure 3.

Figure 5 is a fragmentary bottom perspective view of the tip of Figure 3 shown in the closed position.

15              Figure 6 is a fragmentary top perspective view of another embodiment of a cutting tip made in accordance with the present invention, showing the movable jaw in the closed position.

Figure 7 is a fragmentary bottom perspective view of the tip of Figure 6, showing the movable jaw in the opened position.

20              Figure 8 is a schematic view of a cartilage cut with the tip of Figure 3.

Figure 9 is a cartilage cut with the tip of Figure 6.

25              Figure 10 is a schematic fragmentary view of a knee undergoing arthroscopic surgery using the punch of Figure 1.

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**DETAILED DESCRIPTION OF THE INVENTION**

A surgical punch R using the present invention is disclosed in Figure 1. The punch R comprises an arm 2 with a finger hole 4 and an axially elongated support or shank 6 secured to the arm 2. Another arm 8 with a finger hole 10 is pivotally secured to the arm 2 at pivot 12.

The punch R has a cutting tip 14 disposed at the end portion of the shank 6. The tip 14 comprises a fixed jaw 16 and a movable jaw 18. The movable jaw 18 is operably connected to the arm 8 such that pivoting of the arm 8 about the pivot 12 causes opening and closing of the jaw 18 relative to the jaw 16 in a tissue-severing shearing action.

The movable jaw 18 is pivotably secured to the lower jaw 16 at pivot 20, as best shown in Figure 2. A coupling member 22 disposed within a longitudinal groove 24 in the support 6 is pivotably secured to the movable jaw 18 at pivot 26, which is offset with respect to the pivot 20. The other end of the coupling member 22 is operably secured to the arm 8 and adapted to push and pull the member 22 and thereby close and open the jaw 18 as the arm 8 is pivoted about the pivot 12.

The tip 14 is generally rectangular in shape, as best shown in Figures 3, 4 and 5. The tip 14 is wider than the width of the shank 6. The fixed jaw 16 has an opening 28 adapted to receive the movable jaw 18 closely in a tissue-severing shear action. A plurality of upstanding blades 30 are disposed within the opening 28 in grid-like fashion, as best shown in Figure 3. The blades 30 have

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cutting edges 32 that are disposed toward the movable jaw 18. The movable jaw 18 includes a plurality of slots 34 that mate and receive the corresponding blades 30 when in the closed position, as best shown in Figures 2 and 5.

5 Thus, the slots 34 are arranged in the same grid-like configuration as the blades 30, as best shown in Figures 4 and 5. The blades 30 divide the opening 28 into a plurality of smaller openings or grids 36. A person of ordinary skill in the art will understand that the tissue  
10 fragments generated from the cutting tip 14 will be no larger than the size of one grid or cell 36 defined by the blades 30 and the sides of the opening 28. The blades 30 are disposed transversely to each other and substantially flush with the opening 28.

15 The tip 14 is approximately 3.2 mm wide by 5 mm long, divided into four equal quadrants, each measuring approximately 1.6 mm by 2.5 mm. The suction shaver (not shown) used for meniscectomy has a typical inside opening of 2.7 mm. Thus, the tissue fragments generated by the  
20 punch R will not clog the suction shaver.

The cutting tip 14 is advantageously tapered from wide to narrow towards the distal end of the tip for relatively ease of insertion into the knee, as best shown in Figure 2.

25 Stops 37 provide the limit of travel for the movable jaw 18 in the closed position, as best shown in Figure 5.

Another embodiment of cutting tip 38 is disclosed in Figures 6 and 7. The cutting tip 38 is substantially



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arrow-triangular-shaped with a narrow front portion 40, a wider middle portion 42 and a narrow end portion 44, as best shown in Figure 6. The tip 38 has a fixed jaw 46 and a movable jaw 48 that operates the same way as that disclosed for the tip 14. The fixed jaw 46 has an opening 50 in which is disposed a plurality of blades 52, thereby dividing the opening 50 into a plurality of smaller openings or cells 54, as best shown in Figure 7. The movable jaw 48 has a plurality of slots 56 that are arranged to mate and receive the blades 52 when the jaw 48 is in the closed position, as similarly shown in Figure 2 for the tip 14.

The tip 38 has rounded cutting edges 58 disposed substantially at the front and middle portions of 40 and 42 and somewhat rounded straight cutting edges 60 intermediate of the rounded cutting edges 58, as best shown in Figure 6. In effect, the cutting tip 38 has a somewhat triangular rounded shape to advantageously provide different shapes of bites on the tissue being cut. The curvature of the cutting edges 58 is less than the curvature of the cutting edges 60.

The tip 38 is advantageously tapered from wide to narrow along its longitudinal axis extending away from the support 6 for relative ease of insertion into the surgical site, as best shown in Figure 2 for the tip 14.

Cuts 59 made by the tip 14 on a cartilage 61 is disclosed in Figure 8. Bites 63 made by the tip 38 is disclosed in Figure 9. Note that the bites 63 made by the tip 38 are more circular, advantageously providing a better

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partial meniscectomy, since the meniscal cartilage being trimmed has a curved shape.

In operation, the punch R is used in arthroscopic surgery, as best shown in Figure 10. A fiber-optic device  
5 62 is inserted into the knee 64 to provide an image of the surgery site in a video monitor 66. Fluid inflow 68 and outflow 70 connected to cannulas 69 and 71 provide for the clearing of tissues cut by the punch R and to distend the knee joint.

10 For a meniscectomy, the device R is inserted between the femur 72 and the tibia 74 to gain access to the meniscal cartilage lying therebetween. If a big suction shaver were inserted between the femur 72 and the tibia 74, it could damage the articular cartilage and this would be  
15 poor surgical technique. Therefore, the punch R advantageously makes tissue fragments that will not clog the outflow 70 or suction shaver. Additionally, the suction shaver used at this site is limited in size, making the small fragments generated by the punch R advantageously  
20 desirable.

The arrow-shaped tip 38 advantageously provides for easier penetration of the surgical site. In arthroscopy, small holes called port holes are cut with a sharp pointed scalpel. The holes are sometimes difficult  
25 to penetrate with a square tipped instrument. The arrow-shaped tip 38 advantageously penetrates the knee relatively more easily.

In doing meniscectomy, where the meniscus has a round shape, it is advantageous to take round bites when

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trimming about the curved-shaped meniscus. The tip 38 is not completely circular, but with basically a triangular rounded shape, whereby simply turning and angulating the punch R can provide different shapes of bites on the

5 meniscus.

While this invention has been described as having preferred design, it is understood that it is capable of further modification, uses and/or adaptations following in general the principle of the invention and including such  
10 departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as may be applied to the essential features set forth, and fall within the scope of the invention or the limits of the appended claims.

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**I claim:**

1. A surgical punch for cutting body tissue,  
comprising:

- 5                   a) an axially elongated support having  
first and second end portions;
- b) first and second cutting jaws operably  
associated with said first end portion and movable between  
an open position and a closed position relatively toward  
10 and closely past each other in tissue-severing shearing  
action;
- c) an actuator operably associated with  
said second end portion for providing relative motion  
between said first and second jaws;
- 15                  d) said first jaw having an opening adapted  
to receive said second jaw in tissue-severing action in the  
closed position;
- e) a plurality of blades disposed within  
said opening for dividing said opening into a plurality of  
20 smaller openings; and
- f) said second jaw cooperating with said  
blades when in the closed position, thereby to cut the  
tissue into smaller fragments substantially corresponding  
to the sizes of said smaller openings.

25                  2. A surgical punch as in Claim 1, wherein:

- a) said second jaw includes a plurality of  
slots adapted to receive the respective blades when said  
second jaw is in the closed position.

3. A surgical punch as in Claim 1, wherein:

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a) said blades are substantially transverse to each other.

4. A surgical punch as in Claim 1, wherein:

a) said blades are substantially flush with said opening.

5. A surgical punch as in Claim 1, wherein:

a) said first and second jaws are substantially rectangular in plan view.

6. A surgical punch as in Claim 1, wherein:

a) said actuator includes a first handle;

b) a second handle pivotably secured to said first handle; and

c) a coupling member secured to said second jaw and said second handle for moving said second jaw between said open and closed positions relative to said first jaw.

7. A surgical punch as in Claim 6, wherein:

a) said support includes a groove; and

b) said coupling member is disposed within said groove.

8. A surgical punch as in Claim 1, wherein:

a) said second jaw is pivotably secured to said support.

9. A surgical punch as in Claim 1, wherein:

a) said first jaw is tapered from wide to narrow along its longitudinal axis extending away from said support.

10. A surgical punch as in Claim 9, wherein:

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a) said first and second jaws are wider than the width of said support.

11. A surgical punch as in Claim 1, wherein:

a) said first and second jaws are  
5 substantially arrow-triangular-shaped.

12. A surgical punch as in Claim 11, wherein:

a) said first and second jaws each includes arcuate outer and middle portions with a first curvature and arcuate portions between said outer and middle portions  
10 with a second curvature larger than the first curvature.

13. A surgical punch as in Claim 11, wherein:

a) said first jaw is tapered from wide to narrow along its longitudinal axis extending away from said support.

14. A surgical punch as in Claim 11, wherein:

a) said first and second jaws each includes a middle portion wider than the width of said support.

15. A surgical punch for cutting body tissue, comprising:

a) an axially elongated support having first and second end portions;

b) first and second cutting jaws operably associated with said first end portion and movable between an open position and a closed position relatively toward  
25 and closely past each other in tissue-severing shearing action;

c) an actuator operably associated with said second end portion for actuating said second jaw relative to said first jaw;

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d) said first jaw having an opening adapted to receive said second jaw in tissue-severing action in the closed position;

e) a plurality of blades disposed  
5 substantially transversely to each other and in the direction of motion of said second jaw within said opening for dividing said opening into a plurality of smaller openings; and

f) said second jaw including a plurality of  
10 slots adapted to receive the respective blades when said second jaw is in the closed position, thereby to cut the tissue into smaller fragments substantially corresponding to the sizes of said smaller openings.

16. A surgical punch as in Claim 15, wherein:

15 a) said first jaw is tapered from wide to narrow along its longitudinal axis extending away from said support.

17. A surgical punch as in Claim 15, wherein:

a) said first jaw is wider than the width  
20 of said support.

18. A surgical punch as in Claim 15, wherein:

a) said first and second jaws are  
substantially arrow-shaped.

19. A surgical punch as in Claim 18, wherein:

25 a) said first and second jaws each includes arcuate outer and middle portions with a first curvature and arcuate portions between said outer and middle portions with a second curvature larger than the first curvature.

20. A surgical punch as in Claim 19, wherein:

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a) said first jaw is tapered from wide to narrow along its longitudinal axis extending away from said support.

21. A surgical punch as in Claim 19, wherein:

5 a) said first and second jaws each includes a middle portion wider than the width of said support.

22. A surgical punch for cutting body tissue, comprising:

10 a) an axially elongated support having first and second end portions;

b) first and second cutting jaws operably associated with said first end portion and movable between an open position and a closed position relatively toward and closely past each other in tissue-severing shearing  
15 action;

c) an actuator operably associated with said second end portion for actuating said first jaw relative to said second jaw;

20 d) said first and second jaws being substantially arrow-shaped in plan view;

e) said first jaw having an opening adapted to receive said second jaw in tissue-severing action in the closed position;

25 f) a plurality of blades disposed within said opening for dividing said opening into a plurality of smaller openings;

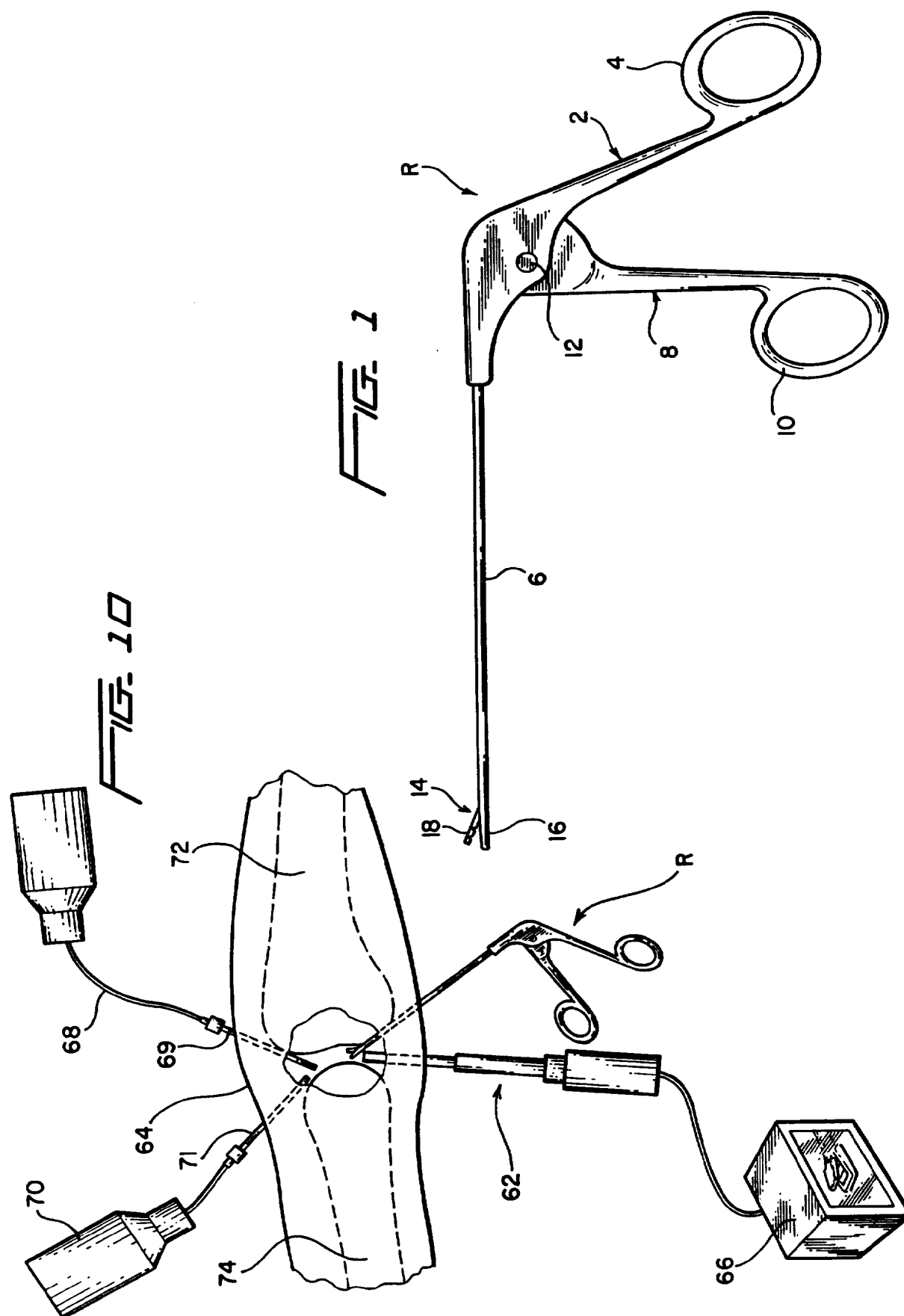
g) said blades being substantially transverse to each other; and

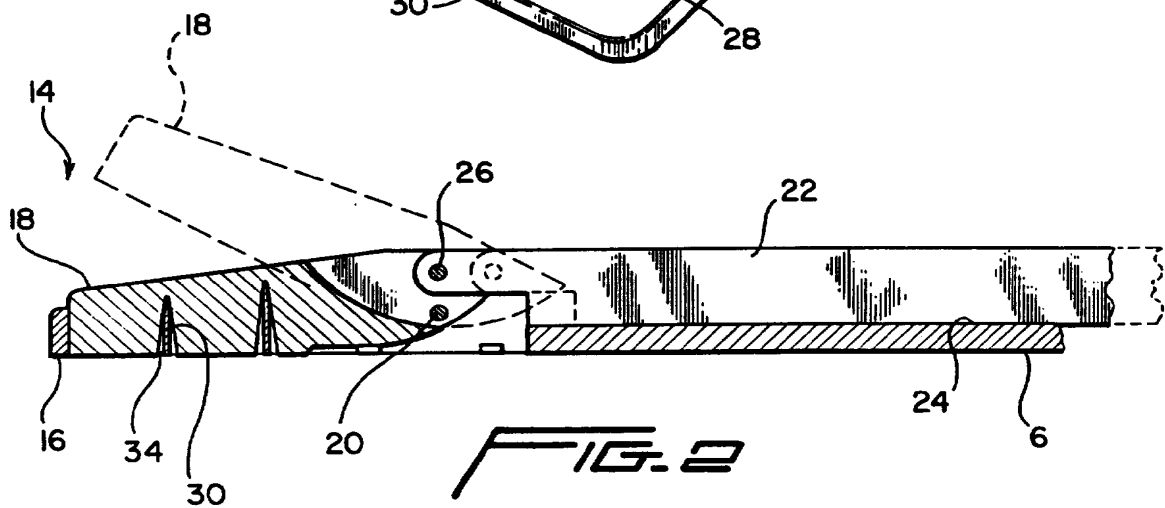
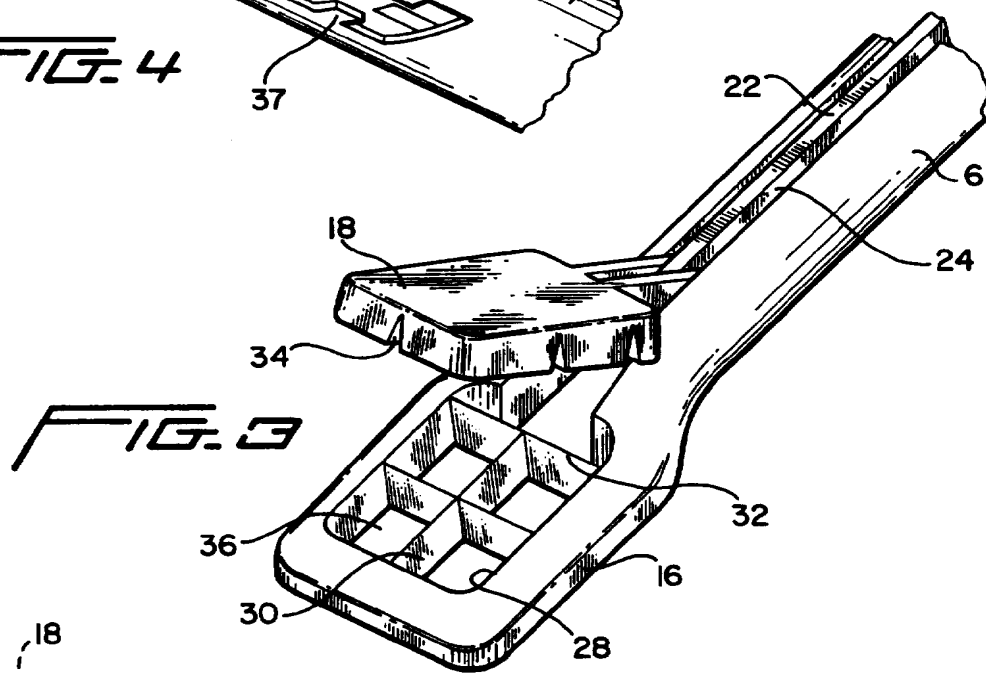
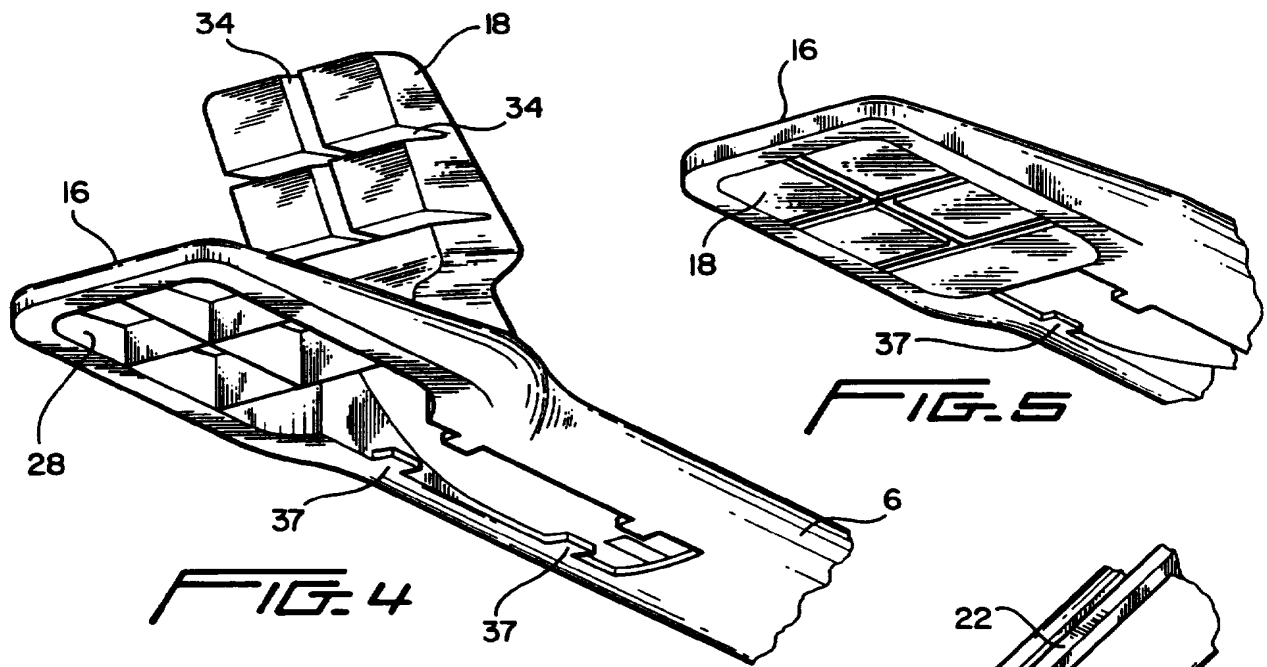


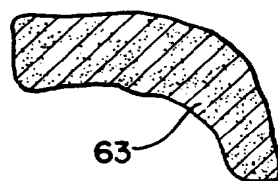
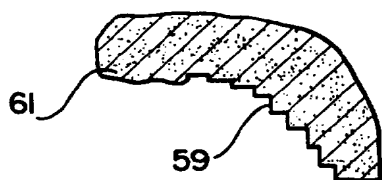
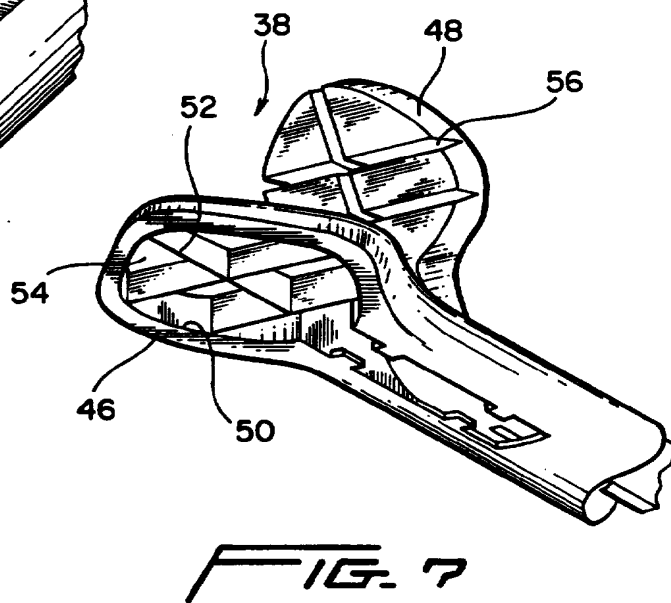
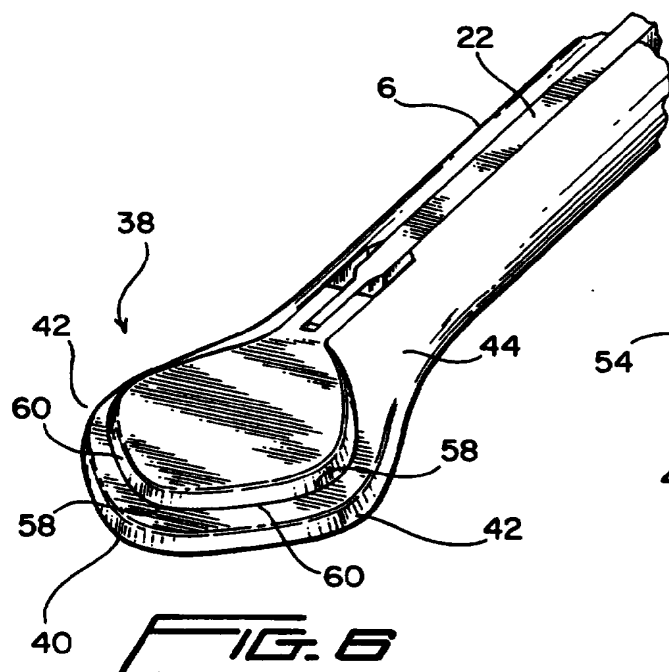
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h) said second jaw including a plurality of slots adapted to receive the respective blades when said second jaw is in the closed position, thereby to cut the tissue into smaller fragments substantially corresponding to the sizes of said smaller openings.

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## INTERNATIONAL SEARCH REPORT

International application No.

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**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :A61B 17/14, 17/32

US CL :606/184

According to International Patent Classification (IPC) or to both national classification and IPC

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U.S. : 30/229, 304, 305; 128/751, 754; 606/170, 174, 184, 207

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
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NONE**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---, P Y	US, A, 5,303,472 (MBANUGO) 19 April 1994, see whole document.	1-8, 15, 17 ----- 1-4, 6, 8, 9-22
Y	US, A, 2,778,357 (L. LEIBINGER ET AL.) 22 January 1957, see whole document.	1-4, 6, 8, 9-22



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